



George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

QD-A-007

REVISION: A

EFFECTIVE DATE: December 6, 2004

ORGANIZATIONAL INSTRUCTION

Professional Development Roadmap (PDRM) for Project Assurance Engineers

OPR(s)

All QD Departments

OPR DESIGNEE

David Spacek

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 2 of 23

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		10/22/04	New document.
	A	12/6/04	Administrative change - removed Apprentice as a qualification

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 3 of 23

Professional Development Roadmap for S&MA Project Assurance Engineers

1. PURPOSE, SCOPE, APPLICABILITY

1.1 Purpose – This Organizational Instruction (OI) establishes a voluntary training and development roadmap for Project Assurance Engineers within the Marshall Space Flight Center (MSFC) Safety and Mission Assurance (S&MA) Directorate. This OI identifies the minimum level of training, knowledge and skills that MSFC S&MA Project Assurance Engineers shall acquire in developing their expertise.

1.2 Scope – This OI shall serve as a development roadmap for Project Assurance Engineers who support Agency, MSFC, and other NASA Center programs and projects. It provides a comprehensive list of training, knowledge requirements, and on-the-job (OJT) experience needed by MSFC S&MA Project Assurance Engineers to effectively execute their duties.

This roadmap establishes two qualification levels (Level I and Level II) and provides a process for progressive qualification at each level. This roadmap shall be used in conjunction with Individual Development Plans (IDP) to encourage Project Assurance Engineers to pursue development activities most appropriate to their Department.

1.3 Applicability – This OI applies to all MSFC S&MA personnel who seek to provide S&MA Project Assurance Engineering services, including in-house and offsite, and who choose to participate. Personnel shall satisfy the prerequisites specified in Appendix A before participating in this roadmap process. Mission Support Contractor personnel are also encouraged to participate in this voluntary program or in a contractor tailored program approved by the MSFC S&MA Director.

2. DOCUMENTS

2.1 Applicable Documents

- 2.1.1 MPR 3410.1 Training
- 2.1.2 QD-A-003 Professional Development Roadmap (PDRM) for Reliability and Maintainability Engineers
- 2.1.3 QD-A-004 Professional Development Roadmap (PDRM) for Quality Engineers
- 2.1.4 QD-A-005 Professional Development Roadmap (PDRM) for System Safety Engineers

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 4 of 23

2.2 Reference Documents

None

3. DEFINITIONS

3.1 Professional Development Roadmap (PDRM) – instrument to identify and document the minimum training, knowledge requirements and on-the-job (OJT) experience needed by MSFC S&MA personnel at two levels of the Project Assurance Engineer expertise development.

3.2 Individual Development Plan (IDP) – a document developed jointly by the employee and their supervisor to plan the employee’s training and development needs as well as to identify possible training solutions. The plan will focus on immediate and short-term goals that are in line with the longer-term goals of both the employee and the organization.

3.3 Qualification – the act of verifying and documenting that personnel have completed the required training and have demonstrated the specified proficiency.

3.4 Qualification levels – are defined as:

- **Level I:** Engineer providing a single point of contact (POC) between the S&MA Directorate and the Program/Project, responsible for coordinating all S&MA activities. An engineer qualified at this level has demonstrated an understanding of the basic skills required of a Project Assurance Engineer.
- **Level II:** Engineer providing a single point of contact (POC) between the S&MA Directorate and the Program/Project, responsible for coordinating all S&MA activities. An engineer qualified at this level has demonstrated an understanding of the basic and advanced skills required of a Project Assurance Engineer.

3.5 Qualification Criteria – are specified in Appendix A and include three categories of accomplishments that demonstrate discipline expertise:

- Training – traditional, on-line and computer based.
- On-the-Job training (OJT) – demonstrating specific skills thru actual on-the-job experience.
- Reference documents – demonstrating an understanding of applicable documentation such as requirements, standards, handbooks, etc.

3.6 Prerequisites – requirements that shall be satisfied prior to participating in this PDRM process are specified in Appendix A.

3.7 Application for Qualification: - shall be submitted by the candidate seeking qualification upon completion of the requirements for each level. Application consists of:

- Completed and approved application Form (Appendix B).
- Completed and approved copy of Appendix A, for Level I or Level II qualification.

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 5 of 23

3.8 Implementation Requirements – specific actions required to initially implement this OI. (See section 4.1).

3.9 Qualification of Experienced Personnel – are earned by documenting a candidate’s previously completed training and development. (See section 4.3).

3.10 Qualification by Designation (Grandfathering) – Qualification achieved prior to completion of the required PDRM line items. This shall be done only during the initial process implementation stages to create a discipline Champion and Mentors. Personnel qualified in this manner are expected to document their qualifications as soon as possible thereafter. (See section 4.4).

3.11 Equivalent Training Criteria – are training classes or experiences that may be substituted for those specified in Appendix A. During the initial stages of the program, or when new employees are transferred into S&MA, previously completed items may be substituted with approval of the discipline Champion. Thereafter, the Champion must approve all equivalent criteria in advance.

3.12 Personnel and Roles

3.12.1 Candidate – a civil service employee or mission support contractor who seeks qualification via the PDRM process.

3.12.2 Supervisor – the organizational line manager who provides supervisory functions and responsibilities for employee positions requiring training and/or qualification. The supervisor helps create, and approves, the candidate’s IDP, verifies completion of the OJT requirements, and recommends the candidate for qualification.

3.12.3 Mentor – a qualified Level II Project Assurance Engineer who is selected as, and who agrees to perform as, a coach to the candidate in the PDRM qualification process. Mentors are also responsible for verifying the candidate’s understanding of the required reference documents.

Mentors shall be selected from those qualified at Level II. A Project Assurance Engineer who does not meet the qualification requirement, but who has extensive and relevant experience, may be approved to serve as a Mentor on a case-by-case basis. This exception requires approval by the candidate’s supervisor and the discipline Champion.

3.12.4 Project Assurance Engineering Champion – an individual recognized as a key leader in the Project Assurance Engineering discipline, and is designated by the S&MA Director (or his/her designee). The Champion is responsible for the technical content of this PDRM, approval of any “equivalent” criteria, selecting and training Mentors, and participation in the Qualification Review Board.

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 6 of 23

3.12.5 Qualification Review Board – is responsible for reviewing and approving qualification applications. The Board shall consist of the S&MA Director (or his/her designee), the Project Assurance Engineering Champion, and other key individuals selected by the S&MA Director. The Board shall also review and approve any changes to this OI.

3.13 PDRM Designation Memorandum – a document signed by the S&MA Director that identifies S&MA personnel who are authorized to serve as Project Assurance Engineering Champion, Mentors and Qualification Review Board members.

4. INSTRUCTIONS

4.1 Implementation Requirements – Implementation of this OI shall begin upon approval by the S&MA Director, and shall require the following additional actions:

- Selecting the Project Assurance Engineering Champion, and designating (grandfathering) him/her to be qualified at Level II.
- Selecting Project Assurance Engineering Mentors, and designating (grandfathering) them to be qualified at Level II.
- Appointing Qualification Review Board Members.
- Publishing the PDRM Designation Memorandum.
- Authorizing and initiating a work task for the Project Assurance Engineering Champion and/or Mentors to prepare a set of checklists and sample questions to be used as guidelines for demonstrating candidate knowledge of the reference documents.
- Formalizing and baselining the in-house courses identified in Appendix A that are currently taught informally by NASA employees and mission support contractors
- Communicating to all S&MA personnel the existence, purpose, expectations, process and names of key personnel associated with this OI.

4.2 Qualification Process (Normal) - A candidate seeking qualification shall use the following process. This process is further illustrated in the flow chart in Section 11.

4.2.1 Candidate declares his/her S&MA specialty as a Project Assurance Engineer. The candidate's Supervisor shall approve this declaration.

4.2.2 Candidate documents completion of prerequisites using a completed copy of the application form (Appendix B). The candidate becomes an Apprentice.

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 7 of 23

4.2.3 Supervisor assigns a Mentor (with support from the Project Assurance Engineering Champion).

4.2.4 Apprentice works with his/her supervisor to augment their IDP to include appropriate items from the PDRM. (Appendix A).

4.2.5 Apprentice pursues the required developmental activities per the PDRM and IDP.

4.2.6 Upon completion of each developmental activity, the Apprentice obtains the proper signature as shown in the following table:

Criteria Type	Required Activity	Verifying Signature
Training Classes	Complete successfully	Class Certificate
Reference Documents	Demonstrate understanding	Mentor
OJT Experiences	Complete successfully	Supervisor

4.2.7 Upon completion and documentation of all required activities for qualification, the Apprentice completes the application form (Appendix B), obtains the signature of the Project Assurance Engineering Champion and submits the completed package to his/her Supervisor. Note: It is not necessary to complete 100% of the items listed in Appendix A. When the candidate, with the concurrence of the Mentor and Project Assurance Engineering Champion, has completed a sufficient amount of the Appendix A items to become qualified, he/she may submit the package to his/her Supervisor for concurrence.

4.2.8 Supervisor approves the application and forwards it to the S&MA Director for action by the Qualification Review Board.

4.2.9 The Qualification Review Board reviews the application and makes the approval decision.

4.2.10 An Apprentice may become qualified first at Level I and continue the above process to become qualified at Level II, or may elect to accomplish all of the required activities to become qualified at Level II from the beginning.

4.3 Qualification of Experienced Personnel - Existing S&MA personnel and new personnel hired/transferred into S&MA, who are experienced in the Project Assurance Engineering discipline, may seek qualification at Level I or Level II by documenting their previously completed achievements and using the following process. This process is further illustrated in the flow chart provided in Section 11.

4.3.1 Candidate documents previously completed training classes and OJT achievements in Appendix A:

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 8 of 23

- Equivalent training and experiences may be substituted for the criteria specified in the appendix with the approval of the discipline Champion.
- The Training Department shall verify training classes. Candidates are responsible for providing proof (e.g. copies of certificates, grade reports and/or transcripts) of non-NASA training to the Training Department.
- OJT shall be verified by signature of the Supervisor.

4.3.2 Candidate shall demonstrate his/her understanding of the reference documents using the normal qualification process (See section 4.2).

4.3.3. Upon completion and documentation of all required activities for qualification, the candidate completes the application form (Appendix B), obtains discipline Champion approval and submits the package to his/her Supervisor for approval. Note: It is not necessary to complete 100% of the items listed in Appendix A. When the candidate, with the concurrence of the Mentor and Project Assurance Engineering Champion, has completed a sufficient amount of the Appendix A items to become qualified, he/she may submit the package to his/her Supervisor for concurrence.

4.3.4 Supervisor approves the application and forwards it to the Qualification Review Board for action.

4.3.5 The Qualification Review Board reviews the application and makes the approval decision.

4.4 Qualification by Designation (Grandfathering) – During the initial PDRM process implementation, the S&MA Director (or his/her designee) may qualify the Project Assurance Engineering Champion and Mentors prior to their completion of the PDRM application. Any personnel so qualified are expected to document their qualifications per the PDRM process for experienced personnel (section 4.3) as soon as possible thereafter.

4.5 Maintaining Qualification - It is expected that personnel qualified at Level II shall continue to receive training related to the Project Assurance discipline.

4.6 Process Measurement - shall be accomplished by baselining the number of personnel qualified at each level, and thereafter by measuring the progress toward advanced qualification by S&MA personnel. The baseline shall be created 6 months after implementation. Measurements shall be made semi-annually thereafter. Each semi-annual measurement shall determine the percentage of S&MA personnel qualified, and estimate the progress (percent complete) of each participating individual toward the next higher qualification. Department Managers shall report this measurement at the next scheduled Monthly Status Review.

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 9 of 23

4.7 Amendments – Changes to this Organizational Instruction shall be made per the documented Organizational Instruction Change Process. The Qualification Review Board shall review proposed changes to this PDRM prior to submitting them to the MSFC S&MA Director for approval. The custodial responsibility for this PDRM shall be assigned to the Safety, Reliability, and Quality Assurance Policy and Assessment Department (QD40).

5. NOTES

5.1. OI Replacement - None

6. SAFETY PRECAUTIONS AND WARNING NOTES

None

7. APPENDICES, DATA, REPORTS, AND FORMS

- A – PDRM for Project Assurance Engineers
- B – Qualification Application Form

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 10 of 23

8. QUALITY RECORDS

<u>Quality Record</u>	<u>Repository</u>	<u>Period of Time</u>
Completed PDRM (Official Course completion information will be kept by the MSFC Training Office)	S&MA Training Officer	Maintained in accordance with NRRS 3/33 (G.2) for 2 years hardcopy - after which hardcopy is converted to electronic format and retained for duration of employment

9. TOOLS, EQUIPMENT, AND MATERIALS

None

10. PERSONNEL TRAINING REQUIREMENTS

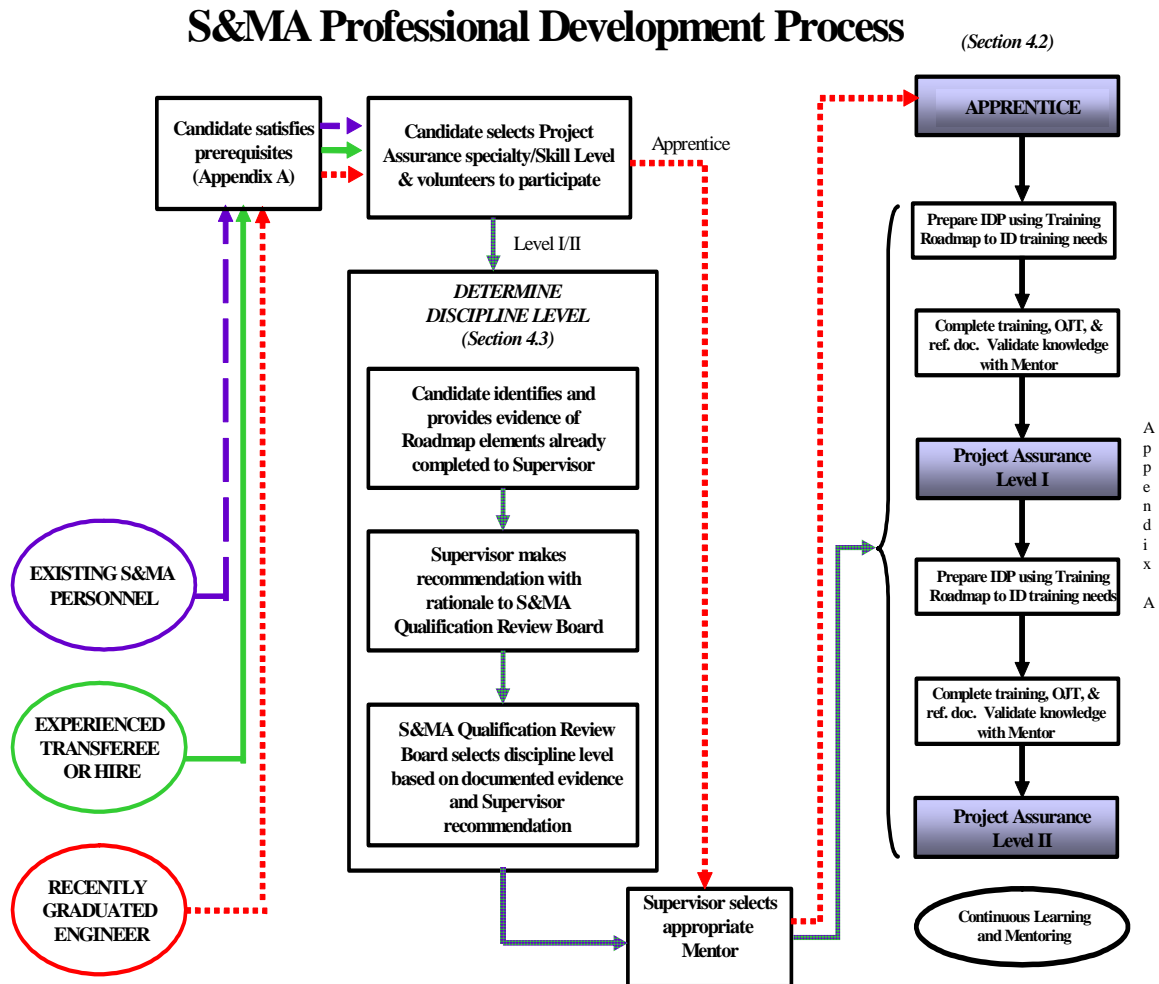
See Appendix A - B

11. FLOW DIAGRAM

The flow diagram (Figure 11-1) illustrates the PDRM Qualification process described in this OI.

Organizational Instruction		
Professional Development Roadmap (PDRM) for Project Assurance Engineers	QD-A-007	Revision: A
	Date: December 6, 2004	Page 11 of 23

Figure 11-1



Notes:

1. Qualification Review Board is the decision authority for qualification levels and approvals.

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

A.1 Objective:

This Appendix provides the qualification criteria for Project Assurance Engineers to be qualified at Level I and Level II, using the process described in the body of this Organizational Instruction.

A.2 Prerequisites:

Prior to beginning the process, the candidate shall qualify as an Apprentice by satisfying the following prerequisites:

1. Candidate shall have an appropriate engineering/scientific degree (chemical, electrical, electronic, industrial, mechanical, system, or equivalent) and, if civil service, be classified as an Aerospace Technology Professional (AST).
2. Candidate shall volunteer to participate in the PDRM Qualification program, declare his/her specialty as Project Assurance Engineer, and obtain approval of his/her immediate supervisor.
3. Candidate shall complete the S&MA Overview Orientation Class (4 hour internal class).
4. Candidate shall complete a program/project(s) specific overview orientation class for the candidate's assigned program/project(s), including the S&MA aspects of that program/project(s).
5. Candidate shall be skilled in the use of the MS Office Suite including Word, Excel and PowerPoint, and shall show evidence of capability to make an effective presentation.

A.3 Experience:

The Project Assurance Engineer candidate shall be minimally qualified as a NOVICE in one of the following S&MA fields: System Safety; Reliability/Maintainability, and/or Quality Engineering (refer to applicable PDRM).

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Skill Levels are defined as : Level-I = Basic, Level-II = Advanced

An "x" in the Skill I Column indicates a requirement for Level I Qualification. All items are required for level II qualification.

Training Sources left blank will be determined on a case-by-case basis by the Supervisor, Mentor, or Discipline Champion

For Training Sources with multiple recommendations, it will be left to the Supervisor, Mentor, or Discipline Champion to determine how many sources are necessary for qualification.

IBT = Instructor based training

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
A. Training Classes					
I. ORIENTATION					
A. NASA Background	X	X			
B. Roles and Missions	X	X			
C. Field Installation (Where Employed)	X	X			
D. SMA Document Tree	X	X	S&MA Documentation (SMA-058-01)		
E. SMA Overview	X	X	Mission Assurance Planning (SMA-037-01)		
F. Individual Field Installation SMA Program/Project	X	X	Resident Management Office Activities (SMA-053-01)		
G. Systems Engineering	X	X	Design and Development (SMA-014-01D)		
H. Continuous Process Improvement	X	X			
II. ACQUISITION AND CONTRACT ADMINISTRATION					
A. Acquisition Process					
1. System Phases/Life-cycle Applications	X	X	Acquisition Process (SMA-002-01)		
2. Program Reviews	X	X	Acquisition Process (SMA-002-01)		
3. Preparation of System Specifications		X			
4. Preparation of Statement of Work		X	PBC SOW and Requirements (SMA-045-01)		
5. Project Audits and Reviews	X	X	Audits and Reviews (SMA-004-01)		
6. Space Environmental Considerations		X			
7. Configuration Management/Document Traceability	X	X	Configuration Management (SMA-005-01)		
8. Nonconformance Reporting - Processing	X	X	Material Review Board (SMA-033-01)		
9. Life-cycle Cost		X			
B. Contract Administration					
1. Contract Approaches and Types		X	Contract Terms and Conditions (SMA-006-01)		
		X	PBC SOW and Requirements (SMA-045-01)		
2. Basic Contract Law		X			
3. Federal Acquisition Regulation (FAR)/NASA FAR Supplement		X	Federal Acquisition Regulation (SMA-018-01)		
4. Award Fees		X			
5. Cost Proposals/Contract Changes		X			
6. Contract Authority		X			
7. Source Evaluation/ Selection Boards		X	Source Evaluation Board training (MSFC)		
8. DCMC/DCAA Interface		X	NASA Interface with the DCMC/DCAA (IBT Course Code ZQDCMCA)		
	X	X	NASA/DCMC Memoranda of Agreement/Delegation (SMA-039-01D)		

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
9. Contractor Interface	X	X	Contractor Policies, Procedures and Practices (SMA-009-01)		
10. Remedies/Corrective Action Strategies	X	X	Remedies/Corrective Action Strategy (SMA-052-01)		
11. Contractor Oversight/Insight	X	X	Contractor Performance Surveillance (SMA-008-01)		
	X	X	Insight Versus Oversight (SMA-025-01)		
C. Program/Project Management					
1. Project/Program Surveillance		X	Introduction to the Project Surveillance Plan (IBT)		
	X	X	Overview of the Project Surveillance Plan (SMA-048-01D)		
		X	Project Surveillance Plan Workshop (IBT)		
2. Project Management Systems		X	Cost/Schedule Control (SMA-011-01)		
	X	X	Management System Overview (SMA-029-01)		
	X	X	Mission Assurance Planning (SMA-037-01)		
		X	Management Systems/Processes (IBT Course Code SMA-029-01D)		
	X	X	System Requirements - NET Class		
		X	Comprehensive Systems Skills - NET Class		
3. Management Skills		X	Foundations of Project Management - APPL class		
		X	Systems Management - APPL class		
4. Project Flow Communications	X	X			
5. Performance Metrics/Indicators		X	Developing Useful Metrics (SMA-015-01)		
		X	Performance Metrics/Indicators (IBT)		
6. Data and Status Reporting	X	X	Data and Status Reporting (SMA-013-01)		
		X	Data Management (SMA-012-01)		
III. RISK MANAGEMENT					
A. Risk Management Principles and Concepts	X	X	Risk Management Overview (SMA-055-01)		
	X	X	Risk as a Resource (SMA-057-01)		
	X	X	Continuous Risk Management Overview: MSFC Class		
B. Risk Management Planning	X	X	Risk Management Plan Development (SMA-056-01)		
C. Risk Management Tools	X	X	Fault Tree Analysis (SMA-080-02)		
D. Risk Management in Program/Project Management	X	X	Participation in Program/Project Risk Management training (conducted by S&MA RM instructors)		
IV. SOFTWARE					
A. Software Life Cycle	X	X	Software Assurance (SMA-061-01)		
1. Systems Requirements Flowdown	X	X			
2. Software Requirements Analysis		X			
3. Software Design		X			
4. Implementation	X	X			
5. Software Test Facility Requirements		X			

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
6. Software Test	X	X	Systematic Software Testing – NET Class		
7. Installation and Checkout	X	X			
8. Sustaining Engineering		X			
B. SRM&QA Software Assessments					
1. Software Safety Analysis and Requirements Definition	X	X	Software System Safety (SMA-062-01)		
	X	X	Software System Safety (NSTC 025)		
2. Software Criticality/ Risk Assessment (SMA)		X			
3. Software Process Analysis		X			
4. Test Data Collection, Anomaly Reporting, and Tracking		X			
5. Software IV&V	X	X			
V. SAFETY					
A. Safety Regulations and Guidelines		X	System Safety for Managers (NSTC 048)		
		X	Manage - To Be Safe (SMA-028-01)		
1. National Level	X	X			
2. NASA Agency-level Policies and Procedures	X	X			
3. Contractor Practices		X	Occupational Ergonomics (NSTC 225)		
		X	Control Team/Crew Resource Management (NSTC 026)		
4. Safety Variance Policy	X	X			
B. Safety Management		X	Manager's Safety Course (NSTC 005)		
		X	Senior Manager's Safety Course (NSTC 827)		
1. Emergency Preparedness		X			
2. Safety Motivation and Awards Program		X			
3. Information Sources, Training Resources, and Publications		X			
C. Safety Analysis Methods and Techniques	X	X	Fundamental Safety (SMA-019-01)		
		X	System Safety (SMA-066-01)		
		X	System Safety Fundamentals (NSTC 002)		
		X	System Safety Workshop (NSTC 008)		
		X	Payload Safety Review and Analysis (NSTC 011)		
	X	X	System Safety in Acquisition (NSTC 023)		
	X	X	System Safety Special Subjects (NSTC 015)		
		X	Payload Safety Review Process and Requirements (NSTC 016)		
		X	System Safety Basics: MSFC S&MA Class (2 hours)		
	X	X	Advanced System Safety Practices (NSTC 021)		
	X	X	Advanced Topics in System Safety Workshop: New Class (3 days)		
		X	Fault Tree Analysis (SMA-080-02)		
1. Hazard Analysis, Mitigation, and	X	X	Basic System Safety Practice (NSTC 020)		

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Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
Control		X	Characteristics of Effective Hazard Reports : MSFC S&MA Class (2 hours)		
2. Mishap and Accident Investigation		X	MORT-based Mishap Investigation Refresher (NSTC 014) 2-day		
	X	X	Mishap Reporting Familiarization (SMA-036-01D)		
		X	Mishap Investigation Board Refresher (NSTC 004)		
		X	Space Shuttle Crash Investigation Overview (NSTC 027)		
		X	Human Factors in Mishap Investigation (NSTC 012) 2-day		
		X	Management Oversight and Risk Tree (MORT) Based Mishap Investigation (NSTC 006)		
		X	Space Shuttle Crash Investigation (NSTC 018)		
		X	Incident Reporting Information System (IRIS) (SMA-024-01D)		
		X	Root Cause Analysis (NSTC 049) (3 days)		
3. Ergonomics, Human Factors, and Man-machine Interface		X	Occupational Ergonomics (NSTC 225)		
		X	Control Team/Crew Resource Management (NSTC 026) 2-day		
D. Safety Data, Documentation, and Reporting					
1. Types and Sources	X	X			
2. NASA Safety Reporting System	X	X	NASA Safety Reporting System (SMA-038-01)		
E. Operational Safety					
1. Operations (e.g., launch)	X	X	Operational Safety (SMA-043-010)		
		X	Situational Awareness (NSTC 034)		
2. Test and Evaluation	X	X			
3. Chemical Laboratories		X	Laboratory Safety and Health (NSTC 224)		
4. Industrial Operations		X			
5. Facility/Industrial Safety and Hygiene		X	Hazard and Operability Analysis (HAZOP) (NSTC 828)		
		X	Facility System Safety (NSTC 001)		
		X	Confined Space Safety (NSTC 806)		
		X	Lockout/Tagout (NSTC 814)		
		X	Electrical Safety Standards (NSTC 309)		
		X	Aerial Platform Training (NSTC 030)		
		X	Fall Protection (NSTC 311)		
		X	Machinery and Machine Guarding (NSTC 204)		
		X	Forklift Safety (NSTC 209)		
		X	Forklift Safety Refresher (NSTC 210)		
		X	Overhead Cranes and Material Handling (NSTC 205)		
		X	Mobile Crane Safety (NSTC 208)		

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
		X	Safety in High Pressure Systems (NSTC 315)		
		X	Overhead Cran Overview (NSTC 028)		
		X	Guide To Voluntary Compliance (NSTC 501)		
		X	Cryogenics Safety (NSTC 313)		
	X	X	Office Worker Safety (SMA-042-01)		
6. Motor Vehicle Safety	X	X	Seat Belt Safety (SMA-060-01D)		
7. Construction Safety		X	Scaffolding Safety (NSTC 312)		
		X	Construction Safety and Health (NSTC 200)		
8. Explosive Operations		X	Explosive Handler's Course (NSTC 009)		
		X	Explosive Safety Management and Engineering (NSTC 007)		
		X	Explosive Safety Program Management (NSTC 010)		
9. Nuclear and Radiation Safety		X	Space Nuclear Safety Review Process (SMA-041-01)		
10. Aviation Safety		X	Aircraft Mishap Investigation (NSTC 019)		
11. Environmental Considerations and Safety Awareness	X	X	Orbital Debris (SMA-044-010)		
12. Hazardous Materials	X	X	Battery Safety (NSTC 036)		
		X	Hydrogen Safety (NSTC 037)		
		X	Hypergol Safety (NSTC 040)		
F. Fire Safety					
1. Protection and Prevention		X	Fire Protection Theory and Practice (NSTC 207)		
		X	Life Safety Code (NSTC 217)		
G. Personnel Safety Training and Certification					
1. Career Development	X	X			
2. Certified Safety Professional		X	Certified Safety Professional (CSP) Fundamentals Examination Study Course (NSTC 003)		
3. Certification Requirements for Potentially Hazardous Operations and Materials		X			
4. Safety Instructor Training		X			
5. Training Records Process		X			
VI. RELIABILITY AND MAINTAINABILITY					
A. Reliability Principles and Concepts (Including Human Factors)	X	X	Design for Reliability (NSTC 017)		
		X	Reliability and Maintainability Overview (SMA-051-03)		
		X	Design For Availability (NSTC 017)		
B. Mathematical Models		X			
C. Allocation, Prediction, Assessment, and Analysis Methods	X	X	Failure Modes and Effects Analysis (FMEA)/Critical Items List (CIL) (SMA-017-01)		
D. Reliability Testing and Planning	X	X	R&M And The Approval Subprocess (SMA-082-01)		

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Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
		X	R&M and the Evaluation Subprocess (SMA-084-01)		
		X	R&M and the Formulation Subprocess (SMA-081-01)		
		X	R&M and the Implementation Subprocess (SMA-083-01)		
E. Failure/Problem Reporting and Corrective Action	X	X			
F. Trade-off Analysis		X			
G. EEE Parts and Derating	X	X	Electrical, Electronic, and Electromechanical (EEE) Parts (SMA-016-01)		
H. GIDEP/Alerts	X	X	GIDEP Participation and The NASA Advisory System (SMA-020-01)		
I. Materials and Processes		X			
J. Logistics		X			
K. Human Factors		X			
L. Reliability Centered Maintenance		X			
M. Certified Reliability Engineer		X	Certified Reliability Engineer (NSTC 401)		
VII. QUALITY ASSURANCE					
A. Interpreting Engineering Drawings	X	X			
B. Trend Analysis/Statistical Techniques		X			
C. Fracture Analysis/Control	X	X			
D. NASA Interface	X	X	Contractor Interfaces (SMA-007-01)		
F. Design and Development					
1. Design and Development Activities	X	X	Design and Development (SMA-014-01D)		
2. Document Control	X	X	Export Control (ECP-001-01)		
G. Manufacturing Operations/Processes					
1. Manufacturing Tools		X			
2. Material/Process Planning		X	Material/Process Planning (SMA-034-01)		
3. Qualification and Testing	X	X	Testing (SMA-067-01)		
	X	X	Qualification (SMA-049-01)		
4. Rework and Repair	X	X	Rework and Repair (SMA-054-01)		
5. Workmanship Standards	X	X	Workmanship Standards (SMA-070-01D)		
6. Receiving Inspection	X	X	Receiving Inspections (SMA-050-01)		
7. Contamination Control		X			
8. Manufacturing Resources Planning		X	Manufacturing Resources Planning (MRP II) (SMA-032-01)		
H. Quality Assurance/Control	X	X	Basic Quality Training: In-house S&MA class (2 hours)		
	X	X	Second Level Quality Training: In-House S&MA class (2 hours)		
	X	X	ISO 9000 To Quality Systems: MSFC Class		
1. As-designed versus As-built	X	X	As-designed versus As-built (SMA-003-01)		
2. Inspection Planning	X	X	Inspection Planning (SMA-026-01)		
3. Mandatory Inspections	X	X	Mandatory Inspections (SMA-030-01)		
4. Operator Certification/ Training		X	Training and Certification (SMA-068-01)		

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
5. Acceptance/DD250	X	X	Acceptance/DD250 Material Inspection Receiving Report (MIRR) (SMA-001-01)		
6. Preventive/Corrective Action	X	X	Preventive Action/ Corrective Action (SMA-046-01)		
7. Vendor Surveillance/ Management/Purchase Orders	X	X	Vendor Surveillance (SMA-069-01D)		
8. Process Control	X	X	Process Control (SMA-047-01)		
	X	X	Manufacturing Process Controls (SMA-031-01)		
9. Cost of Quality/Scrap, Rework, and Repair	X	X	Cost of Quality (SMA-010-01)		
10. Stamp Control		X	Stamp Control (SMA-064-01)		
11. Metrology		X	Metrology and Calibration (SMA-035-01)		
12. Calibration		X	Metrology and Calibration (SMA-035-01)		
13. Inspection Techniques					
a. Inspection Tools		X			
b. NDE/NDT	X	X	Nondestructive Test and Evaluation (SMA-040-01D)		
c. Test Procedures	X	X			
d. Test Facility Requirements		X			
I. Electrostatic Discharge (ESD)	X	X	Electrostatic Discharge Control Training (GSFC/JPL)		
J. Electronics					
1. Circuit Boards	X	X	Rework, Repair, and Modification of Printed Wiring Assemblies (GSFC)		
2. Surface Mount Technology		X	Surface Mount Technology (GSFC/JPL)		
3. Conformal Coating	X	X	Conformal Coating and Staking (GSFC/JPL)		
4. Crimping Wire Wrap, Cable Harness and Fabrication	X	X	Crimp, Cable, and Harness (GSFC/JPL)		
5. Soldering	X	X	Soldering (GSFC/JPL)		
6. Connectors	X	X	Connector Contact Separation Force Testing/Mate and Demate (JPL)		
	X	X	Flight Systems Connector Cleaning (JPL)		
K. Materials	X	X	Fiber Optic Terminations, Cable Assemblies, and Installation (GSFC/JPL)		
L. Mechanical Parts		X	Flight System Mechanical Assemblies (JPL)		
M. Critical Hardware Handling	X	X	Program Critical Hardware Orientation Training - MSFC Self Study Course		
N. Supplier Management		X	Supplier's Quality Program Plan (SMA-065-01)		
O. Auditing/Surveying	X	X	Audit Planning & Standards - MSFC Self Study Course		
P. Certified Quality Engineer/Technician		X	Certified Quality Engineer (NSTC 400)		
		X	Certified Quality Technician (NSTC 402)		
VIII. OTHER					
A. Ethics	X	X	Ethics/Standards of Conduct (ETH-002-01)		
B. Communications					
1. Team Building	X	X	Developing High Performing Teams – MSFC Class		

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
2. Conflict Management		X	Constructive Conflict Resolution – MSFC Class		
3. Effective Meetings	X	X	Effective Meeting Skills - MSFC Self Study Course		
4. Consulting Skills		X	FPM – Foundations of Project Management – MSFC Class		
5. Negotiating Skills	X	X	MIP – Managing The Influence Process – Wallops Class		
6. Presentation Skills	X	X	Communicating For Results – MSFC Class		
7. Technical and Business Writing	X	X	Technical Writing – MSFC Class		
C. Budget/Resources		X	Understanding Full Cost (FM-001-04)		
	X	x	Core Financial SAP Starter Course (Course Code ZIFM1047)		
D. Lessons Learned, Best Practices, Testing	X	X	Lessons Learned Information System (LLIS) (SMA-027-01)		
E. Other					
1. International Culture Indoctrination		X			
2. Computer	X	X			
3. Diversity	X	X	Cultural Diversity Leadership Program – MSFC Class		
4. Leadership	X	X	Decision Making & Problem Solving: Decision Making Essentials – MSFC Self Study Course		
		X	Leading From the Inside Out: MSFC Class		
		X	Principles of Leadership, Coaching, and Mentoring – MSFC Class		
		X	Crossing Department Lines - NASA HQ Class		
		X	Leadership/Teamwork Class Elective		
5. Time Management	X	X	Time Management (CC) - MSFC Self Study Course		
B. On-The-Job Training (OJT) Activities				Initials	Date
Under appropriate supervision, observe/support review of contract statement of work in support of a NASA project or program.	X	X			
Lead a team reviewing a contract statement of work in support of a NASA project or program.		X			
Under appropriate supervision, observe/support requirements review in support of a NASA project or program.	X	X			
Conduct (or participate on a team conducting) requirements review in support of a NASA project or program.		X			
Observe/support at least two different types of design reviews in support of a NASA project or program.	X	X			
Perform (or participate on a team performing) at least two different types of design reviews in support of a NASA project or program.		X			

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
Observe/support a Flight Readiness Review in support of a NASA project or program	X	X			
Perform (or participate on a team performing) a Flight Readiness Review in support of a NASA project or program		X			
Under appropriate supervision, observe/support conduct of internal audit in support of a NASA project or program.	X	X			
Under appropriate supervision, observe/support conduct of external audit in support of a NASA project or program.	X	X			
Perform (or participate on a team performing) an internal audit in support of a NASA project or program.		X			
Perform (or participate on a team performing) an external audit in support of a NASA project or program.		X			
Lead an S&MA team performing an external audit in support of a NASA project or program.		X			
Observe a Safety Review in support of a flight project or program.	X	X			
Lead a Safety Review in support of a flight project or program	X	X			
Under appropriate supervision, observe/support a Failure Investigation to determine cause and corrective action in support of a NASA project or program	X	X			
Participate in a Failure Investigation to determine cause and corrective action in support of a NASA project or program		X			
Participate in inter-program or inter-center coordinating activity to enhance MSFC and/or NASA expertise in your discipline.	X	X			
Under appropriate supervision, observe/support conduct of hazard analysis in support of a NASA project or program.	X	X			
Conduct (or participate in a team conducting) a hazard analysis in support of a NASA project or program.		X			
Observe a team creating a fault tree in support of a NASA project or program	X	X			
Create (or contribute to a team creating) a fault tree in support of a NASA project or program		X			
Spend 2 weeks at RMO facility observing Sr. RMO activities		X			
Observe Launch Simulation at Huntsville Operations Support Center HOSC	X	X			
Participate and assist Primary on console for at least 2 Launch Simulations at the HOSC	X	X			
Lead as Primary on console for at least 3 Launch Simulations including one Contingency Simulation at the HOSC		X			
Participate and assist Primary on console for at least 4 Launches at the HOSC	X	X			

APPENDIX A: PDRM for Project Assurance Engineers: Qualification Requirements

Training Topics	Skill Levels		Training Sources	Initials	Date
	I	II			
Lead as Primary on console in at least 4 Launches at the HOSC		X		_____	_____
Participate on NASA Engineering and Quality Audit team (NEQA)	X	X		_____	_____
Mentor other personnel in your discipline to help them improve their skills/expertise. This can be as a mentor to others in this PDRM process or as an informal coach in your daily work.		X		_____	_____
C. REFERENCE DOCUMENTATION				Initials	Date
S&MA Requirements Tree	X	X		_____	_____
From S&MA Requirements Tree: Safety and Health documents; Reliability and Maintainability documents; Quality Assurance documents		X		_____	_____
Shuttle Safety Requirements	X	X		_____	_____
ISS Element System Safety Requirements and Processes	X	X		_____	_____
Shuttle and ISS Payloads System Safety Requirements and Process Standards	X	X		_____	_____
Expendable Launch Vehicles Safety Requirements and Process Standards	X	X		_____	_____
"A History of Aerospace Problems, Their Solutions, Their Lessons" by Robert S. Ryan: NASA Technical Paper 3653.		X		_____	_____
Note: A specific set of reference documents and applicable sections pertaining to the subjects listed above must be listed and signed off for each candidate applying for qualification.					

APPENDIX B: PDRM for Project Assurance Engineers: Application for Certification

This application is for (Check One):

- ___ Entry into the PDRM Qualification process as an Apprentice;
All prerequisites have been satisfied
- ___ PROJECT ASSURANCE ENGINEER, LEVEL I Qualification
Appendix A is attached and approved
- ___ PROJECT ASSURANCE ENGINEER, LEVEL II Qualification
Appendix A is attached and approved

Name of Candidate: _____

Organization: _____

Building/Location: _____

Phone: _____ Email: _____

Signatures:

Candidate Signature: _____ Date: _____

Discipline Champion: _____ Date: _____

Supervisor Signature: _____ Date: _____

S&MA Director: _____ Date: _____
(or designee)